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Maple

(*Acer* Species)

By H. S. Betts, *senior engineer, Division of Forest Products*

The maples that grow in the United States include 20 or more species. Of these, sugar maple is by far the most important as well as the most abundant. Other maples of commercial importance are black maple, silver maple, red maple, boxelder, and bigleaf maple. The commercial maples grow throughout the eastern United States and in southeastern Canada, with the exception of bigleaf maple, which grows on the western coast. They form a very conspicuous and beautiful part of the landscape in the fall of the year, when their leaves turn red or crimson. All of the maples produce seed with ample wings, so that there is considerable seed distribution by wind. Sugar maple grows more slowly than the soft maples.

The heavy, hard wood of sugar maple resists abrasion especially well. Sugar maple flooring is widely used and gives excellent service under severe conditions such as are found in dance halls, bowling alleys, and shops. Considerable quantities of sugar maple also go into furniture, boxes and crates, shoe lasts, handles, woodenware, distillation, veneer, railroad ties, and pulpwood. About one-third of the maple lumber produced comes from Michigan, where over one-fifth of the total stand is located. In the production of hardwood lumber maple ranks third (1942), being exceeded only by oak and sweetgum. Maple sugar, made by boiling the sap of the sugar maple, has had much to do with the widespread popularity of the tree.

Nomenclature.—The six species of maple of commercial importance in the United States are listed in Table 1.

Table 1.—*Maple species of commercial importance in the United States*

Common name	Botanical name	Other names
Sugar maple	*Acer saccharophorum*	Hard maple. Rock maple. Sugar tree.
Black maple [1]	*Acer nigrum*	Black maple. Hard maple Black sugar maple. Sugar maple.
Silver maple	*Acer saccharinum*	White maple. River maple. Water maple. Swamp maple.
Red maple	*Acer rubrum*	Soft maple. Water maple. Scarlet maple. White maple. Swamp maple.
Boxelder	*Acer negundo*	Ash-leaved maple. Three leaved maple. Cut-leaved maple.
Bigleaf maple	*Acer macrophyllum*	Oregon maple.

[1] Black maple, formerly considered a variety of sugar maple, is commonly cut and marketed with sugar maple and used for the same purposes without distinction.

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Quite frequently the wood of the maples is divided into two classes, "hard maple" and "soft maple." Hard maple includes sugar maple and black maple. Soft maple is made up largely of silver maple and red maple with a very small proportion of boxelder. Bigleaf maple is used as such in the regions where it grows.

Distribution and growth.—Sugar maple grows from southern Newfoundland to Minnesota and southward to eastern Texas and

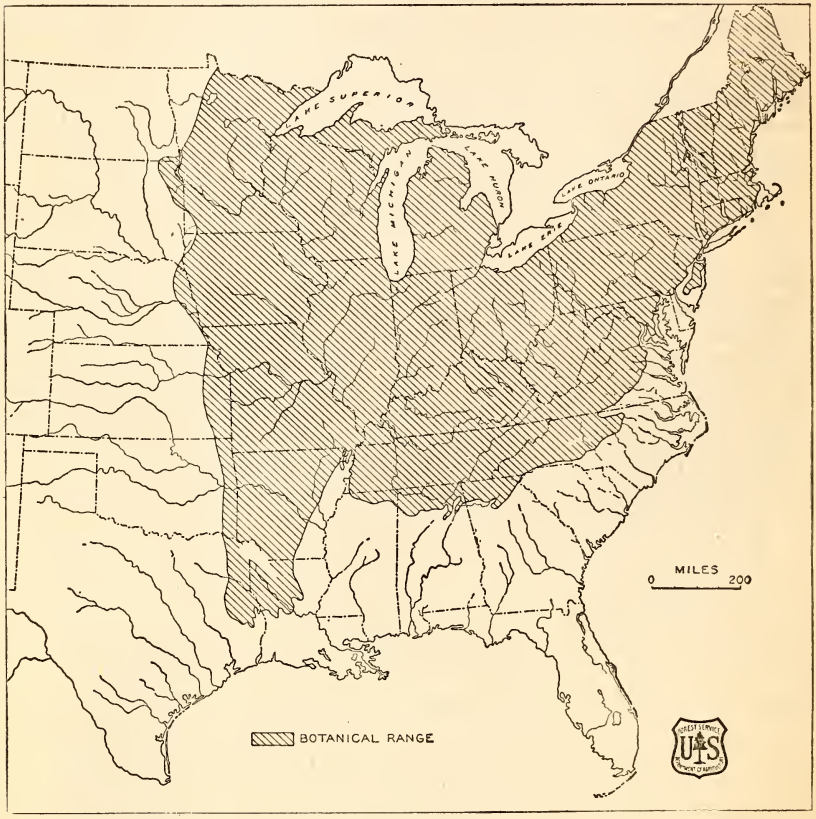

FIGURE 1.—Range of sugar maple (*Acer saccharophorum*) in the United States.

northern Mississippi, Alabama, and Georgia. (See fig. 1 for distribution in the United States.) The largest quantities are in the Lake States and the Northeast. Sugar maple grows singly or in groups in mixed stands of hardwoods. Mature trees ordinarily are from 30 to 40 inches in diameter and 80 to 120 feet in height. Forest-grown trees may have a clear bole of 60 feet. Sugar maple is a prolific seeder, endures shade well, and is able to hold its own on reasonably good soil. It does not do well on poor soil and is not a fast grower at best. Rough averages for the diameter and height growth for several ages of trees are as follows: 20 years—diameter 1 inch, height 14 feet; 40 years—

diameter 2.7 inches, height 32 feet; 100 years—diameter 9.4 inches, height 66 feet.

Black maple has a more limited range of growth than sugar maple. It grows from New England westward to South Dakota, and southward into Missouri, Kentucky, and West Virginia. (See fig. 2.) Black maple is more abundant in the western part of its range than in the eastern part. It grows to about the same size as sugar maple. In summer the heavy, drooping leaves serve to distinguish it from sugar maple.

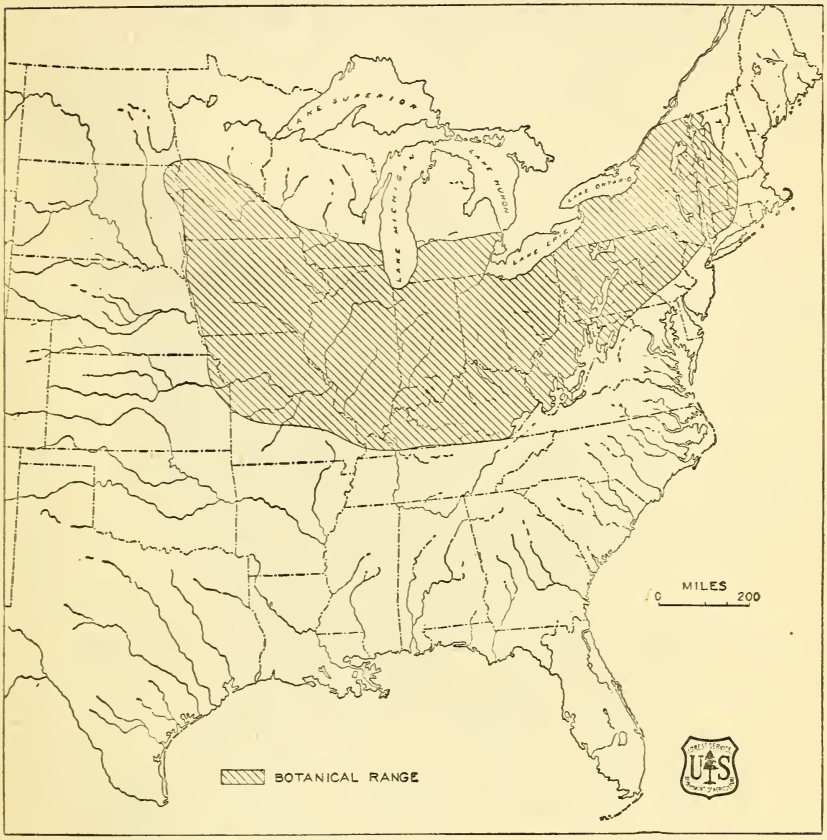

FIGURE 2.—Range of black maple (*Acer nigrum*) in the United States.

Silver maple grows in all States east of the Mississippi and in several west of it. (See fig. 3.) Silver maple has about the same range as sugar maple, except that it does not grow quite so far north in the Lake States nor quite so far south. Like sugar maple, it is found in mixed stands of hardwoods. The largest qantities are in the Ohio River Valley. It grows rapidly and has been extensively planted as a street tree, although quite subject to decay and injury from wind. Mature trees reach a height of 75 to 120 feet and diameter of 2 to 4 feet.

Red maple grows from Canada to Florida and westward to Wisconsin, Iowa, and Texas. (See fig. 4.) It is an exceptionally brilliant tree, putting out red flowers early in the spring, followed by red winged seeds. In the fall the leaves turn a brilliant red or crimson. Red maple reaches its best development in Kentucky, Tennessee, and nearby States. It grows best in damp soil but is not a rapid grower. Average mature trees are about 70 feet high and 2 feet in diameter. In the extreme South red maple becomes a swamp species and is frequently found in the wetter locations associated with black gum.

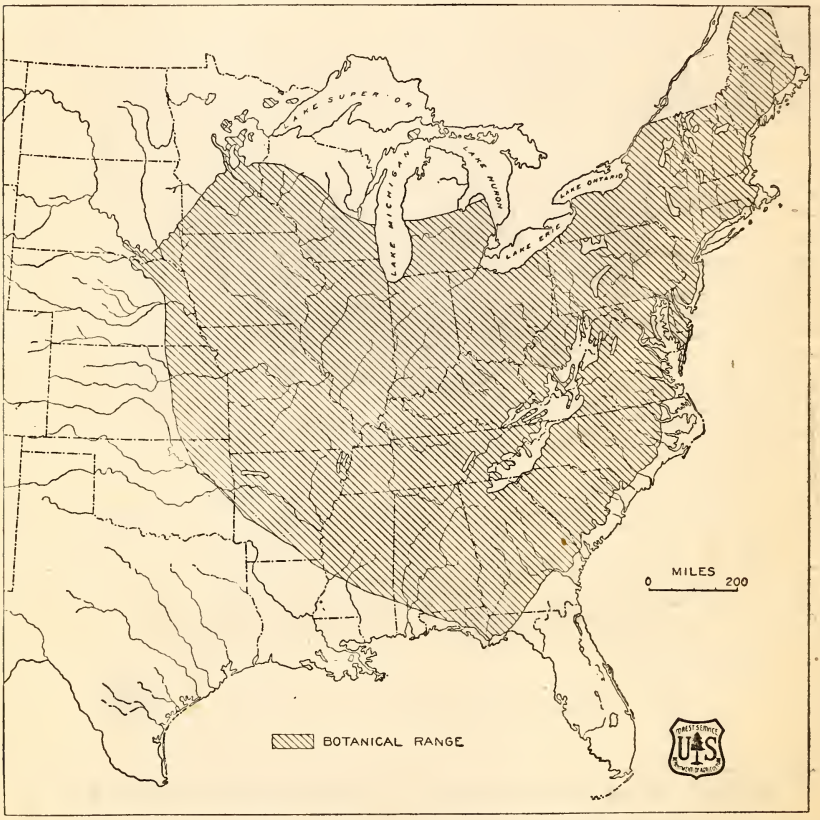

FIGURE 3.—Range of silver maple (*Acer saccharinum*) in the United States.

Boxelder has a wide range, extending over practically all of the United States east of the Rocky Mountains. (See fig. 5.) A variety is also found in Arizona and the southern half of California. The tree grows best in Kentucky and adjoining States in moist situations. It is a short-lived tree, rarely attaining large diameters but grows under a wide range of temperature, elevation, and moisture. Boxelder is the only maple with a compound leaf. Full-grown trees are from 50 to 70 feet high and 1½ to 3 feet in diameter.

Bigleaf maple grows in a rather narrow strip along the western coast of the United States, from Alaska to southern California. (See

fig. 6.) It grows best in Oregon and Washington and is generally found mixed with other species along the banks of streams and in fertile bottom lands. Under favorable conditions the tree reaches a height of 80 or 100 feet. The trunk, however, is generally rather short. The leaves are sometimes a foot wide.

Supply.—An estimate made about 1920 [1] placed the stand of birch, beech, and maple of saw-timber size in the United States at 90,784,000,000 board feet. A later estimate made before 1933 [2] gave the combined stand of the three species at 49,943,000,000 board feet and a still later estimate (1938) [3] placed it at 55,178,000,000 board feet. It is believed that about 60 percent of this, or roughly 33,000,000,000 board feet, was maple. A forest survey conducted in the Lake States [4] showed the following stands of sugar maple [5] and soft maple [6] of saw-timber size (table 2):

TABLE 2.—*Stands of sugar maple and soft maple of saw-timber size*

State	Sugar maple	Soft maple	Total
	Board feet	*Board feet*	*Board feet*
Minnesota	305, 120, 000	110, 640, 000	416, 760, 000
Wisconsin	2, 809, 000, 000	435, 000, 000	3, 244, 000, 000
Michigan	7, 423, 000, 000	1, 197, 000, 000	8, 620. 000, 000
Total	10, 538, 120, 000	1, 742, 640, 000	12, 280, 760, 000

Over one-third of the estimated stand of maple was in the Lake States and over one-fifth of it was in Michigan. Pennsylvania, New York, and West Virginia also contained a considerable proportion of the stand. Sugar maple is the predominant maple in nearly all the States where maple grows,[7] especially in the Lake States and New England, and is estimated to make up three-fourths of the total maple stand.

Production of lumber.—Up to 1921 maple ranked second in the production of hardwood lumber, with oak first. In 1921 the production of sweetgum lumber exceeded that of maple, and maple dropped to third place, where it has remained. The production of maple lumber in 1869 was about 410,000,000 board feet. (See fig. 7.) The cut increased gradually from 1869 to 1905 and then rose rapidly to a maximum of 1,106,604,000 board feet in 1909. Since then it has fallen off and in 1932, a year of business depression, dropped to a minimum of 159,804,000 board feet.

The cut in 1942 was 641,986,000 board feet. It came from 38 States.[8] The average annual production of maple lumber for the 10-year period 1933–42 was 450,271,000 board feet. Michigan has been the leading

[1] U. S. FOREST SERVICE. TIMBER DEPLETION, LUMBER PRICES, LUMBER EXPORTS, AND CONCENTRATION OF TIMBER OWNERSHIP. Rpt. on Senate Res. 311, 66th Cong., 71 pp. 1920.

[2] UNITED STATES FOREST SERVICE. A NATIONAL PLAN FOR AMERICAN FORESTRY. 73rd Cong., 1st sess., Senate Doc. 12, 2 v., 1677 pp. 1933.

[3] UNITED STATES CONGRESS, JOINT COMMITTEE ON FORESTRY. FOREST LANDS OF THE UNITED STATES. 77th Cong., 1st sess., Senate Doc. 32. 44 pp. 1941.

[4] CUNNINGHAM, R. N., and MOSER, H. C. FOREST AREAS AND TIMBER VOLUMES IN THE LAKE STATES. U. S. Forest Serv., Lake States Forest Expt. Sta. Rpt., 84 pp., illus. 1938.

[5] Includes both sugar maple and black maple.

[6] Includes silver maple and red maple.

[7] In Arkansas and Missouri the stand of soft maple probably exceeds the stand of sugar maple.

[8] About 2,500,000 board feet of the 1942 lumber production was bigleaf maple from Washington and Oregon.

State in the production of maple lumber since 1899, and Wisconsin ranked second. Third and fourth places have been occupied by Pennsylvania, West Virginia, or New York. In 1909, the year of maximum production, approximately one-half of the maple lumber produced came from Michigan. In recent years Michigan has furnished about one-third of the maple lumber. In 1943 production was 580,985,000 board feet.

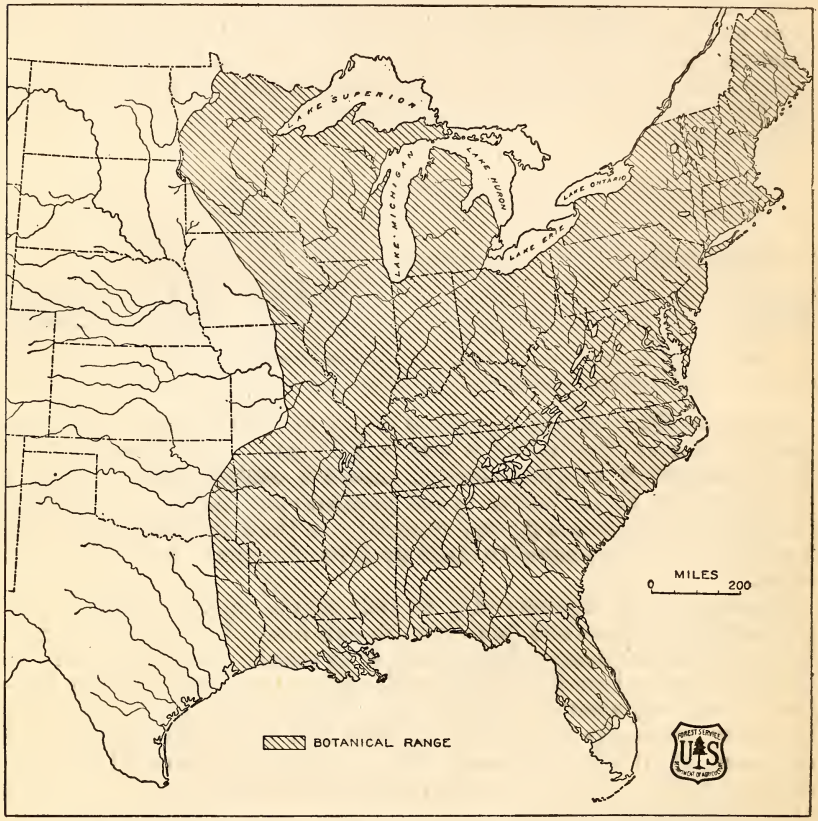

FIGURE 4.—Range of red maple (*Acer rubrum*) in the United States.

Distillation wood.—Maple, birch, and beech are the three principal woods used for hardwood distillation in the production of methanol (wood alcohol), acetate of lime, and charcoal. These three woods, together with comparatively small amounts of other hardwoods, furnished about 1,186,000 cords of distillation wood in 1919. Ten years later (1929)[9] consumption had dropped to 812,000 cords. The average annual consumption in recent years is estimated at 570,000 cords.[10]

[9] Since 1929 distillation statistics of the Bureau of the Census have not included the consumption of hardwoods by cords.

[10] HAERTEL, H. M. TIMBER REQUIREMENTS OF THE HARDWOOD DISTILLATION INDUSTRY. U. S. Forest Serv. Progress Rpt. of the Forest Survey, Requirements Phase, 64 pp. 1938. [Processed.]

Maple probably furnished about one-quarter of this amount, or approximately 140,000 cords, equivalent to 42,000,000 board feet.[11]

Veneer.—The quantity of maple consumed in the manufacture of veneer in 1905 was 26,246,000 board feet log scale. The maximum consumption of 58,676,000 feet occurred in 1944 and the minimum of 10,619,000 feet in 1921. The average annual consumption in recent years has been approximately 31,700,000 feet log scale,[12] equivalent to about 36,500,000 board feet. Among the woods used for veneers in 1939 maple ranked tenth in quantity consumed and furnished about 2.7 percent of the total.

Cross ties.—The number of maple cross ties treated with a preservative[13] by the treating plants in the United States has varied from a minimum of 36,942 in 1915 to a maximum of 2,860,505 in 1928. The average number of maple ties treated annually in the 10-year period 1933–42 was 1,182,355. If it is assumed that 75 percent of all the maple ties are treated, then the total number both treated and untreated would be 1,576,000. If it is also assumed that one-half of the maple ties are sawed[14] and one-half hewed, then the average number of hewed maple ties supplied to the railroads annually would be 788,000, equivalent to approximately 23,640,000 board feet.[15]

Pulpwood.—Beech, birch, and maple are grouped together in the statistics[16] of pulpwood consumption. During the 10-year period 1931–40 consumption of these three woods has varied from a minimum of 65,958 cords in 1932[17] to a maximum of 298,895 yards in 1940, with an average of approximately 155,000 cords per year. If it is assumed that one-half of this is maple, the average annual consumption of maple pulpwood in recent years would be 77,500 cords, equivalent to approximately 23,000,000 board feet.[18] Because of the increased war demand for pulp it is unofficially estimated that about 120,000 cords of maple pulpwood were used in 1944.

Cooperage.—About 30 years ago maple was used in considerable quantities for the manufacture of staves for slack barrels and to some extent for heading for slack barrels. Small amounts were also used for staves and heading for tight barrels. In 1909 a maximum of 133,255,000 maple staves, equivalent to approximately 40,400,000 board feet, was produced.[19] By 1921 production had fallen to 23,902,000 staves. Since then the number produced annually has not been listed separately. The average annual production of maple cooperage stock of all kinds in recent years has probably required the equivalent of not more than 5,000,000 board feet.

The maple used annually for lumber, distillation, veneer, cross ties, pulpwood, and cooperage amounts to about 580,000,000 board feet. In addition, considerable maple in the form of short logs or bolts is used in the manufacture of shoe lasts, handles, spools, sporting

[11] One cord of distillation wood is considered equivalent to 300 board feet.
[12] The following years were included in the average—1929, 1931, 1935, 1937, and 1939.
[13] A large proportion of the maple cross ties used by railroads is treated with a wood preservative to make them resistant to decay. Records of the quantity of wood treated in the United States have been compiled annually by the Forest Service in cooperation with the American Wood-Preservers' Association beginning with 1909.
[14] Sawed ties are classed as lumber and are included in the lumber production figures.
[15] A cross tie is considered to contain 30 board feet.
[16] Bureau of the Census. After 1940 a number of other hardwoods are grouped with beech, birch, and maple in these statistics.
[17] A year of business depression.
[18] A cord of maple pulpwood is considered to contain 300 board feet.
[19] Three slack staves are equivalent to 1 board foot.

goods, toys, and other small products. These logs or bolts are not sawed into lumber but into blocks or pieces of the size and shape required for the products. Such products probably require the equivalent of 100,000,000 board feet of maple. Large amounts of maple are also used for fuel. The average annual cut of maple in recent years for all purposes is estimated roughly at 700,000,000 board feet.

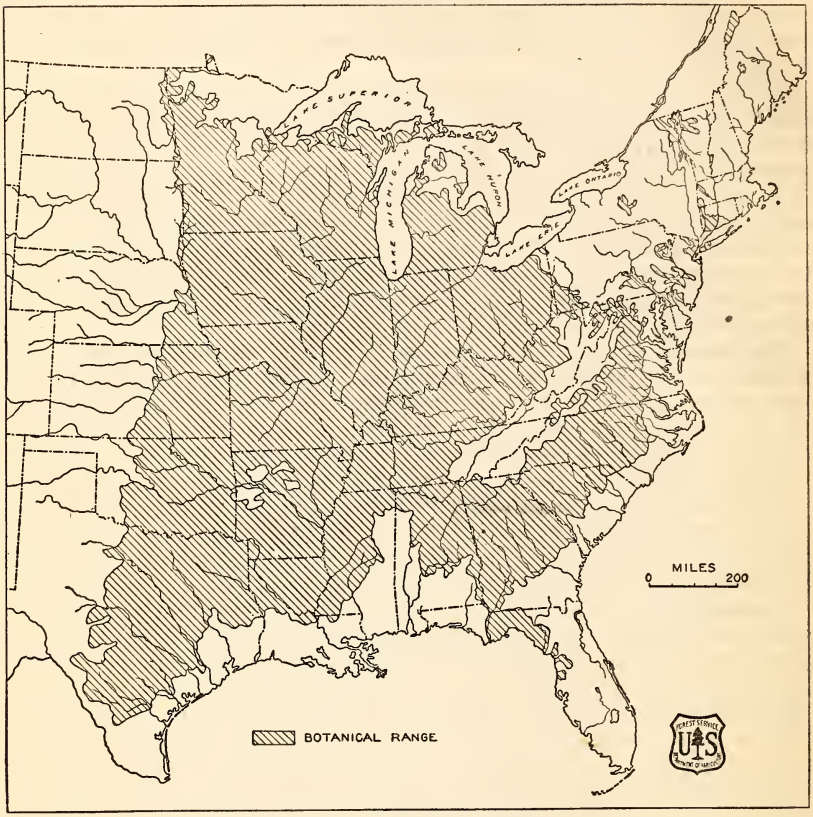

FIGURE 5.—Range of boxelder (*Acer negundo*).

Properties.—The heartwood of sugar maple is light reddish brown. The sapwood is commonly white, sometimes with a slight reddish brown tinge. The average width of sapwood in logs cut in Vermont varied from 3.2 inches in 8-inch logs to 5 inches in 19-inch logs or about 90 percent sapwood in the logs measured. The annual rings are marked by a thin, darker line of denser wood but are not very distinct.

Sugar maple has a fine, uniform texture, turns well on a lathe, is markedly resistant to abrasive wear, and is without characteristic odor or taste. It is harder to work with tools than the softer woods. The wood is heavy,[20] strong, stiff, hard, has a high resistance to

[20] The average weight of sugar maple when thoroughly air-dry (12 percent moisture) is 44 pounds per cubic foot.

shock, and ranks high in nail-holding ability. It has a large shrinkage and presents some difficulties in drying which can, however, be readily overcome by proper methods. The grain is generally straight. Occasionally, however, sugar maple occurs with curly, wavy, or bird's-eye [21] grain.

The wood takes stain satisfactorily and is capable of a high polish. In ease of gluing it has an intermediate rank. In resistance to decay it has a low rank, being classed with birch, ash, spruce, and hemlock in this respect. Black maple approaches sugar maple closely in its properties.

FIGURE 6.—Bigleaf maple (*Acer macrophyllum*) in the United States.

The wood of the soft maples, largely silver maple and red maple, with a small proportion of boxelder, resembles that of the hard maples but is not so heavy,[22] hard, and strong. Red maple is somewhat above silver maple in its strength properties.[23] The sapwood

[21] Bird's-eye maple results, it is thought, from adventitious buds, which distort the grain. These buds remain just beneath the bark but never succeed in forcing their way out.

[22] The average weight of silver maple and red maple in a thoroughly air-dry condition (12 percent moisture) is 33 and 38 pounds per cubic foot, respectively.

[23] Data are not available on the strength of boxelder. It is commonly considered to be the lightest, softest, and weakest of the maples.

in the soft maples is considerably wider than in the hard maples and the heartwood lighter in color. Bigleaf maple ranks between the two soft maples in strength properties.

Both hard and soft maple are classed among the woods whose heartwood is moderately difficult to penetrate with a preservative. The soft maples can be readily made into paper pulp by the soda process [24] to yield a short-fibered, rather weak pulp suitable for mixing with stock from longer fibered woods. The hard maples are difficult to pulp by this process. Both hard and soft maple can be readily pulped by the sulfite process and the resultant pulp easily bleached.

Principal uses.—Maple is used principally for lumber, distillation, veneer, cross ties, and paper pulp. A large proportion of maple lumber, probably as much as 90 percent, is further manufactured into a variety of products, including flooring, furniture, boxes and crates, shoe lasts, handles, woodenware, novelties, motor-vehicle parts, spools, bobbins, etc. Light-colored maple furniture in simple designs and with a rubbed finish has been in vogue for years. The hardness, resistance to abrasion, and uniform texture of sugar maple make it especially suitable for flooring to be subjected to severe conditions of use. For bowling alleys, dance floors, factory floors, etc., it is the outstanding wood. The uniform texture of sugar maple combined with the necessary strength and hardness has made it a preferred wood for musical instruments, especially for piano frames. Other specialty uses for sugar maple are shoe lasts for which it furnishes a large proportion of the wood used, bowling pins, billiard cues, Indian clubs, dumbbells, butcher's blocks, parts of washing machines, churns, chopping bowls, bread boards, cant-hook handles, croquet mallets and balls, and many turned products.

Maple is one of the principal woods used in the hardwood distillation industry for the production of charcoal, acetic acid, and methanol (wood alcohol). Veneer cut from maple is used to a considerable extent for fruit and vegetable packages and also in the manufacture of plywood. Paper pulp made from maple goes largely into book and similar grades of paper.

Sugar maple is the source of maple sugar. The trees are "tapped" in the early spring by boring one or two half-inch holes in each trunk and inserting spouts or tubes, generally of metal. The sap flows from the spouts and is collected in buckets and boiled or evaporated to a sirup. In "sugaring off" the concentration by evaporation is carried further and the sirup becomes a sugar.

A single tree yields from a pint to a gallon of sirup, or from 1 to 8 pounds of maple sugar in a season. The average production per tree in a good sugar grove is about 2½ pounds of sugar or 2½ pints of sirup during a season. It usually takes 32 gallons of sap to make a gallon of sirup or 8 pounds of sugar. In 1860, 1,598,000 gallons of maple sirup

[24] Six processes are used commercially in making paper pulp from wood. One is the mechanical or ground-wood process, in which the wood is reduced to pulp on a grindstone. The yield approaches 100 percent of the weight of the wood. Four are chemical processes—the sulfite, sulfate, soda, and neutral sulfite. They depend upon the dissolving action of chemical reagents which remove essentially all of the binding material (lignin) surrounding the cellulose fibers and leave them in a fairly pure state. The removal of the lignin is accomplished by cooking the wood chips with the proper chemical under steam pressure. The yield of pulp is about one-half the weight of the wood. In a sixth process, the semichemical, part of the lignin is removed by chemical means, and the resultant pulp, containing some lignin, is further refined by mechanical means. The yield of semichemical pulp is intermediate between the yields obtained with the mechanical process and the chemical processes.

and 40,120,000 pounds of maple sugar were produced in the United States from 23 States. For the 10-year period 1928–37 the average annual production was 2,628,000 gallons of sirup and 1,548,000 pounds of sugar from an average of 12,390,000 trees tapped per year. During this 10-year period Vermont led in average annual production of sugar, with New York second and Pennsylvania third. Vermont also led in sirup produced, with New York second and Ohio third. In 1940, 2,680,000 gallons of sirup and 550,000 pounds of sugar were produced from 10,288,000 trees.

Table 3 shows the amounts of maple used in the manufacture of various classes of products in 1912, 1928, 1933, and 1940. The figures include maple in the form of lumber with smaller amounts of logs, bolts, and veneer.

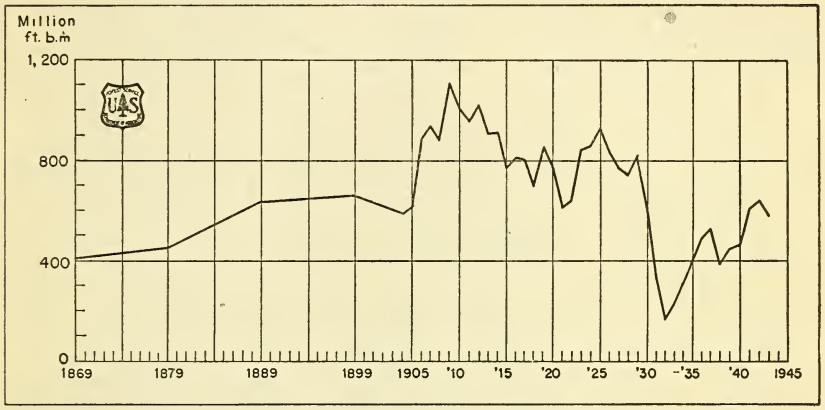

FIGURE 7.—Lumber production of maple (*Acer* species), 1869–1943.

TABLE 3.—*Maple used in the manufacture of wooden products*

[Thousands of board feet]

Classes of products	1912	1928	1933	1940
Airplanes		37	37	160
Agricultural implements	48, 319	6, 985	699	7, 344
Boot and shoe findings	54, 050	46, 894	33, 344	71, 353
Boxes, baskets, and crating	96. 832	99, 535	[1] 45. 187	[1] 155, 591
Boxes, cigar and tobacco	96		322	
Butcher's blocks	[2] 2. 145	[2] 3, 202	[2] 2, 636	5, 741
Car construction and repair	5, 789	5, 862	1, 477	626
Caskets and burial boxes	110	318	120	691
Conduits, pumps, and wood pipe	1, 706	170	40	148
Dairy, poultry and apiary supplies	[3]	136	2, 847	7, 818
Dowels and skewers	[4] 1, 355	[4] 2, 039	[4] 296	2, 712
Electrical equipment	1, 191	4, 957	706	1, 757
Firearms				
Fixtures	20, 761	3, 764	1, 809	3, 631
Flooring	[5]	[5]	69, 373	145, 704
Furniture	134, 837	93, 703	71, 118	144, 789
Handles	43, 715	11, 095	11, 225	33, 769
Instruments, musical	45, 483	9, 542	1, 543	5, 774
Instruments, professional and scientific	4, 425	5, 476	705	1, 742
Ladders	[3]	[3]	2	43
Laundry appliances	14, 219	1, 836	48	9, 159
Machinery	8, 995	1, 916	826	5, 707
Matches	[6] 1, 200		162	17
Patterns and flasks	118	352	41	667
Pipes, tobacco		60	33	36

Footnotes at end of table.

TABLE 3.—*Maple used in the manufacture of wooden products*—Continued

Classes of products	1912	1928	1933	1940
Playground equipment	854	605	282	263
Plumbers' woodwork	388	2,180	1,146	1,400
Printing material	704	635	951	300
Radio and phonograph cabinets	(7)	(7)	100	515
Refrigerators	[8] 6,375	[8] 4,392	1,241	6,450
Rollers, shade and map	880	120	20	273
Sash, doors, general millwork	[9] 318,084	[9] 202,577	[10] 3,258	[10] 6,210
Sewing machines	324	1,108	90	12
Ship and boat building	1,014	300	171	425
Shuttles, spools, bobbins, looms	[11] 13,531	[11] 10,771	[11] 6,973	22,089
Signs, scenery, displays	102	64	10	122
Sporting and athletic goods	4,914	8,918	1,310	13,381
Surgical supplies	147	24		40
Tanks	200	17	43	11
Toothpicks	(12)			
Toys	3,964	4,933	3,588	10,252
Trunks and valises	5,047	6	18	
Vehicles, motor	(13)	205,455	14,201	17,626
Vehicles, nonmotor	55,863	5,593	932	599
Venetian blinds				41
Woodenware and novelties	41,743	11,794	10,104	24,654
Total	919,420	757,371	289,235	[14] 709,642

[1] These figures for 1933 and 1940 include maple used for boxes and crates by plants not classified as manufacturers of wooden products and which were not included in 1912 and 1928. The amounts included for nonmanufacturers of wooden products were as follows: 1933, 8,858,000 board feet, and 1940, 63,166,000 board feet.
[2] Includes skewers.
[3] Included in "Woodenware and novelties."
[4] Dowels only, skewers included in "Butchers' blocks."
[5] Included in "Sash, doors, general millwork."
[6] Includes toothpicks.
[7] Included in "Furniture."
[8] Includes kitchen cabinets.
[9] Includes planing-mill products, such as siding, ceiling and flooring.
[10] Planing-mill products not included in 1933 and 1940 canvasses except flooring, which is listed separately.
[11] Does not include looms.
[12] Included in "Matches."
[13] Included in "Vehicles, nonmotor."
[14] Includes 602,793,000 board feet of lumber, 96,413,000 board feet of logs and bolts, and 10,436,000 board feet of veneer.

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